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CONTACT LENS AND PRODUCTION METHOD THEREOF
[Kontakuto Renzu To Sono Seizo Hoho]

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[Claims] /2*

[Claim 1] A contact lens that has ions injected into the surface of the main body thereof.

[Claim 2] The contact lens stated in Claim 1, wherein the aforesaid ions are the ions of a metal, such as silver, copper, or the like, or the ions of a gas, such as oxygen, nitrogen, argon, or the like.

[Claim 3] A method for producing contact lenses by injecting ions into the surface of the main body of a contact lens.

[Claim 4] The method for producing contact lenses stated in Claim 3, wherein the aforesaid ions are the ions of a metal, such as silver, copper, or the like, or the ions of a gas, such as oxygen, nitrogen, argon, or the like.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application] The present invention pertains to a contact lens and also to a method for producing the same.

[0002]

[Prior Art] Generally speaking, contact lenses can be classified into hard contact lenses and soft contact lenses. The latter contact lenses have an inherent problem in that, because they commonly have a high moisture content, they are susceptible to the adhesion of fungi and bacteria.

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* Numbers in the margin indicate pagination in the foreign text.

[0003]

[Problems that the Invention Intends to Solve] More specifically, soft contact lenses are water-retentive and easily scratched and are susceptible to the adhesion of secretion products (for example, proteins and the like) in tears to the lens surface and also to fungi's entering into the void in soft contact lenses and propagating. The fungi, once propagated, root in the lenses and are difficult to eliminate, and this could lead to loss of sight in rare cases.

[0004] Accordingly, they need to be periodically sterilized by boiling, and it is a troublesome procedure.

[0005] The present invention was achieved to solve these problems, and it intends to inhibit the propagation of bacteria and the like so that the process of washing and boiling contact lenses can be eliminated or can be made easier to perform and also to improve wear comfort when the lenses are worn.

[0006]

[Means for Solving the Problems] The present invention was completed to attain the aforesaid objectives, and it pertains to a contact lens that has ions injected into the surface of the main body thereof.

[0007] Examples of the ions to be injected include the ions of a metal, such as silver, copper, or the like, or the ions of a gas, such as oxygen, nitrogen, argon, or the like.

[0008]

[Operation] Because, as described in the foregoing, the present invention performs ion injection into the surface of the main body of a contact lens, the contact lens proper achieves the effect of inhibiting the propagation of bacteria and the like, and the hydrophilicity of the contact lens is also increased.

[0009]

[Working Examples] The following will explain working examples of the present invention.

[0010] Working Example 1

In this working example, the contact-lens main body was formed from polymethyl methacrylate (PMMA), and silver ions were injected into its surface.

[0011] The following test was carried out to examine the antibacterial effect obtained by injecting silver ions.

[0012] As the sample, PMMA was used, and the shake flask method was used as the test method.

[0013] The test results are shown in Table 1 below.

[0014]

TABLE 1

Injected Amount of Silver Ions	Number of Colonies (pieces)
1×10^{15} ions/cm^2	0
1×10^{16} ions/cm^2	0
Blank (injected amount: 0)	3352

[0015] As is evident from Table 1 above, no propagation of bacteria was observed when a given amount of silver ions was injected.

[0016] Working Example 2

In this working example, the contact-lens main body was formed from polymethyl methacrylate (PMMA), and oxygen ions were injected into its surface.

[0017] The following test was carried out to examine changes in the contact angle of the lens when oxygen ions were injected.

[0018] As the sample, PMMA was used, and the Sessile drop method was used as the test method.

[0019] Water was used as the solvent, and the test was carried out at a temperature of 25 °C.

[0020] The test results are shown in Table 2 below.

[0021]

TABLE 2

Injected Amount of Oxygen Ions	Contact Angle (degrees)
1×10^{14} ions/cm^2	60
1×10^{15} ions/cm^2	52
1×10^{16} ions/cm^2	38
Blank (injected amount: 0)	75

[0022] As is evident from Table 2 above, the injection of a given amount of oxygen ions caused the contact angle to decrease. Further, /3 the decrease of the contact angle became larger as the injected ion amount increased.

[0023] When the contact angle decreases, as mentioned in the foregoing, it means an increase in hydrophilicity. Accordingly, in the present working example, by increasing the hydrophilicity of the lens,

the wear comfort of the lens was improved, thus yielding the effect of making long-term use possible.

[0024] Apparatus for injecting ions

The aforesaid ion injection is carried out with the use of an apparatus for ion injection use shown in Fig. 1.

[0025] That is, in explaining the case of injecting silver ions with this apparatus, the apparatus is configured from a vapor-generating unit (1) for generating a vapor, an ion-forming section (2) for forming ions, an extraction electrode (3) for extracting a beam of the formed ions, an electrode group (4) that shapes and accelerates the extracted ions, a mass segregation unit (5) that selects and takes out the desired silver ions alone, an acceleration electrode group (6) for accelerating the taken-out ions with a given energy, and a chamber (7) that houses PMMA, which is the material of the contact lens to be injected.

[0026] The ion-injection apparatus thus configured is maintained under high vacuum by an evacuation unit (not illustrated).

[0027] The following will explain the procedure of conducting ion injection with this apparatus. First, within the area that is evacuated by the aforesaid evacuation unit, silver is heated inside a heating oven, which serves as the vapor-generating unit (1), thereby generating a vapor, and this vapor is fed to the ion-forming section (2), after which the ions are extracted by the extraction electrode (3) and formed.

[0028] Next, the formed ion beam is shaped by the electrode group (4) and led to the mass segregation unit (5).

[0029] Then, the required silver ions alone are segregated and taken out, after which the taken-out ions are accelerated by the acceleration electrode group (6) and led to the chamber (7), and the ions are applied to the PMMA housed inside the aforesaid chamber (7), thereby injecting the ions into this PMMA.

[0030] Other Examples

Incidentally, the material of the contact-lens main body is not limited to the PMMA used in the aforesaid working example, and it may be a synthetic resin other than this. Since the present invention is mainly intended for application to soft contact lenses, the material is mainly a synthetic resin. However, it is also possible to inject ions into the main body of contact lenses that are made from materials other than synthetic resins--for example, glass and so forth.

[0031] Furthermore, the ion injection method and the type of injection apparatus are also not limited to those used in the aforesaid working example.

[0032] The type of ions to be injected is also not limited to silver ions and oxygen ions used in the aforesaid working example, and it is possible to inject the ions of such a metal as platinum, copper, zinc, or the like, the ions of such a gas as nitrogen, argon, or the like, or other ions.

[0033] The conditions of ion injection and the number of ions to be injected are also not limited.

[0034]

[Effects of the Invention] As explained in the foregoing, according to the present invention, ions are injected into the surface of the contact-lens main body; therefore, when the ions have an antibacterial effect, the contact lens proper achieves the effect of inhibiting the propagation of bacteria and the like, and, as a result, the present invention has the effect of eliminating the need for washing or boiling the contact lens or of making this process easier to perform.

[0035] Furthermore, depending on the type of the ions to be injected, the hydrophilicity of the contact lens is increased, and, as a result, the present invention exhibits the effect of improving wear comfort when the lens is worn by the user.

[Brief Explanation of the Drawing]

[Fig. 1] A schematic drawing of the ion injection apparatus used for injecting ions into PMMA.

[FIG. 1]